Assessment of improved rain suits

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Abstract

Two versions of the 'improved' CF rain suits were compared by twenty non-commissioned members of the Canadian Forces, who wore the rain suits for a period of eight months. Feedback from evaluation questionnaires and focus groups indicates that most of the problems identified are either material/fabric related, or due to minor design inefficiencies, however, the overall design feature specification is acceptable to put into service as it stands.

Résumé

Vingt militaires du rang des Forces canadiennes ont porté pendant une période de huit mois deux versions des combinaisons de pluie « améliorées » des FC en vue de les comparer. La rétroaction obtenue grâce à des questionnaires d'évaluation et à des groupes de consultation montre que les problèmes rencontrés étaient liés soit au matériau tissu soit à des défauts de conception mineurs. Toutefois, dans l'ensemble, la spécification des caractéristiques de conception est suffisamment acceptable pour être mise en service telle quelle.

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Executive summary

The Directorate of Land Requirements (DLR) within the Department of National Defence has initiated a project to develop a new rain suit which will better meet the needs of the Land Force in a more modern environment. Two versions of the rain suit were produced in trial quantities, both having identical features and finished in a Canadian Disruptive Pattern, but made of different materials. The Land Force Trials and Evaluation Unit (LFTEU) and Defence Research and Development Canada – Toronto (DRDC Toronto) were jointly tasked to design and carry out a field trial using these two rain suits to validate the new design and determine which of the two materials is preferred.

A series of questionnaires developed using the Repertory Grid technique were administered to twenty non-commissioned members of the Canadian Forces, who were instructed to wear the rain suits alternately during their normal duties throughout a period of eight months. Analysis of data acquired through questionnaires and focus groups at the conclusion of the trial period showed that most of the problems identified were material/fabric related, and minor design related issues, however, the overall design feature specification is acceptable to put into service as it stands.

Sommaire

La Direction des besoins en ressources terrestres (DBRT) du ministère de la Défense nationale a mis en route un projet visant à réaliser une combinaison de pluie qui répondra mieux aux besoins de la force terrestre dans un milieu moderne. Deux versions de la combinaison de pluie ont été produites en quantité suffisante pour essais. Elles ont des caractéristiques identiques, sont peintes d'un dessin de camouflage canadien mais sont faites de matériaux différents. L'unité d'essais et d'évaluations de la Force terrestre (UEEFT) et Recherche et développement pour la défense Canada – Toronto (RDDC Toronto) ont reçu la mission conjointe de concevoir et d'effectuer l'essai sur le terrain de ces deux combinaisons de pluie afin de valider la nouvelle conception et de déterminer lequel des deux matériaux est préférable.

Une série de questionnaires conçue selon la technique de la grille de Kelly a été remise à vingt militaires du rang des Forces canadiennes, à qui on avait donné la consigne de porter les combinaisons de pluie en les alternant pendant leurs heures normales de travail au cours d'une période de huit mois. L'analyse des données obtenues grâce aux questionnaires et à des groupes de consultation a montré que la plupart des problèmes rencontrés étaient liés au matériau/tissu et à des défauts de conception mineurs. Toutefois, dans l'ensemble, la spécification des caractéristiques de conception est suffisamment acceptable pour être mise en service telle quelle.

Table of contents

Abstract i

Résumé i

Executive summary iii

Sommaire iv

Table of contents v

List of figures vii

List of tables vii

Acknowledgements viii

Introduction 1

Trial Objectives 1

The Improved Rain Suits 2

Methods 3

Subjects 3

Rotating Schedule 3

Questionnaires 5

Data Analysis Strategy 5

Results and Discussions 6

The 36-item Questionnaire 6

An integrated comparison: Bi-plots 9

The 15-item design features checklist 12

Interaction with fabric/material 13

The Order of Importance of Design Features Questionnaire 14

EXIT Questionnaire 15

Conclusion: A summary of findings substantiated by focus group feedback.....18

Rain suit A.....18

Rain suit B.....19

Recommended Modifications.....19

Conclusion.....20

Appendices.....21

List of figures

Figure 1. Total precipitation and ambient temperature ranges, for the period from April to September 2002, in CFB Gagetown, NB.....4

Figure 2. Bi-plot: An integrated comparison of rain suits.....10

List of tables

Table 1. Rotation Schedule.....3

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Introduction

The Directorate of Land Requirements (DLR) within the Department of National Defence has identified the current Canadian Forces Land Force (CF LF) rain suit, as a garment in need of improvement, and has initiated a project to develop a new rain suit which will better meet the needs of the LF in a more modern environment. After many soldier interviews and in conjunction with Canadian industry, an 'improved' rain suit was designed and produced in trial quantities. Two versions of the rain suit were produced, both having identical features and finished in a Canadian Disruptive Pattern, but made of different materials. The Land Force Trials and Evaluation Unit (LFTEU) and Defence Research and Development Canada – Toronto (DRDC Toronto) were jointly tasked to design and carry out a field trial using these two rain suits to validate the new design and determine which of the two materials is preferred.

Trial Objectives

The objectives of this study were to:

1. Objectively evaluate the opinion of the soldiers to determine which rain suit (including the in-service rain suit) is superior in performance and suitability; through the use of carefully designed questionnaires, rating scales, and scaling techniques,

2. Elicit user feedback with respect to the design to validate the features and material-related issues of the rain suits; and

3. Recommend changes (if any) to the design features, in order to better address the needs of CF soldiers.

The Improved Rain Suits

The rain suits can be described as a two-piece design, namely a jacket and pants combination. The jacket is about 3/4 length, with vents lined with mosquito netting on the back (flap) and under the arms (zippered). It also has a hood, which can be folded away into the collar to provide head protection as required. Other improved features are also being incorporated in the rain jacket design. These include a beaver tail, bottom hem and waist elastic draw string, the loop and tab feature to secures jacket between the legs to prevent billowing, the front zipper system protected by a three-way storm flap, zippered pockets with storm flaps, zippered chest pass-through, and Lycra-spandex cuffs with modified Velcro closure.

The rain pants has improved elasticized waistband with additional drawstring to improve fit and aid adjustment. It also has side zippered pockets, as well as, zippered cuffs with elastic band and Velcro closure.

A more detailed description of the suits can be appreciated by reading the features questionnaire seen in Appendix A.

The difference between the two rain suits is the material used in their production, i.e.

1. Rain Suit A is made of a Stedprene on neoprene material, which is a lightweight rubber-like fabric; and
2. Rain Suit B is made of an anti-static nylon material, which is a waterproof, moisture vapour permeable laminated fabric

Methods

Subjects

Twenty non-commissioned members from an artillery unit at Canadian Forces Base (CFB) Gagetown, were randomly assigned to one of two groups, i.e., Group 1 (n=10), & Group 2 (n=10). Each participant received one type A and one type B rain suit. Participants were instructed to wear these rain suits according to a carefully designed schedule (Table 1) instead of their in-service rain suit, and were expected to wear them as much as possible during their normal duties throughout the period from April until December 2002. Photographs of CF soldiers wearing the on-trial rain suits, while training in the field, are presented in Appendix C.

Rotating Schedule

Participants were instructed to follow the rotation schedule below:

Table 1. Rotation Schedule, where A = rain suit type A, and B = rain suit type B.

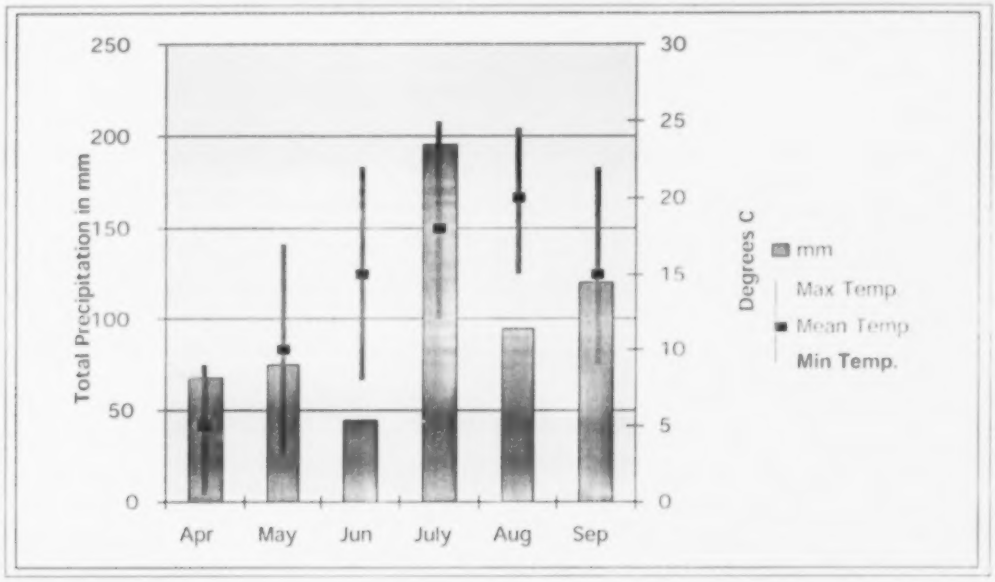
Month		*Apr*	*May*	*Jun*	*Jul*	*Sep*	*Oct*	*Nov*	*Dec*
Mean Temp ° C		4.7	10.3	15.0	18.7	15.3	N.A.	N.A.	N.A.
Rainfall (mm)		66.2	75.7	44.2	194.5	121	N.A.	N.A.	N.A.
Questionnaire					Q I		Q II		Exit Q
Rain suit Rotation	***Group 1***	A	A	B	B	A	A	A	Collect Rain Suits
	Group 2	B	B	A	A	B	B	B	

Participants in Group 1 started off wearing rain suit A in April and switched to rain suit B at the end of May which they continued to wear until the end of June, at which time they provided feedback during the first questionnaire session (i.e., Q I). Participants in Group 1 continued to wear rain suit B until the end of July, then switched to rain suit A, and continued to wear it until the end of September, at which time they provided feedback during the second questionnaire session (i.e., Q II). Group 1's participants proceeded to wear rain suit A until the exit questionnaire (Exit Q) session in December.

Participants in Group 2 followed a similar rotation schedule, but began with rain suit B instead. The purpose of the rotation schedule was to counter balance sequence/order effects, as well as, to ensure participants have equal exposure to the Cool/Moderately Wet (April-June) and Warm/Very Wet (July–September) seasonal weather conditions. By adopting the

rotation schedule, any effects that are due to changes in seasonal weather conditions can be properly assessed. Figure 1 depicts the weather conditions in a graphical presentation.

Figure 1. Total precipitation and ambient temperature ranges, for the period from April to September 2002, in CFB Gagetown, NB.



Questionnaires

To elicit feedback from the participants, a series of questionnaires were designed and administered throughout the trial period (July, October, and December), that respectively correspond to questionnaire sessions QI, QII and Exit Q (refer to Table 1). A set of all questionnaires is presented in Appendix D. They include:

- The 36-item Comparison Questionnaire (9 point scale), based on constructs elicited from SME (subject matter expert) using the Repertory Grid technique - a non-biased interactive knowledge elicitation tool (a description of this technique and the elicitation process is presented in Appendix B);
- the 15-item Design Features Checklist (7 point scale) based on discussions with DLR, the main driving force behind the new design;
- the Order of Importance of Design Features Questionnaire (7 point scale) based on the Design Features Checklist; and
- the Exit Questionnaire (7 point scale)

The 36-item Comparison Questionnaire was administered at questionnaire sessions Q I, Q II and Exit Q, the 15-item Design Checklist was administered at session Q II, and the Order of Importance together with the Exit Questionnaire were administered at the Exit Q session.

In addition, a Semi-Structured Focus Group was conducted at the Exit Q session. The questions used in the focus group were based on issues that were identified as problematic from the exit questionnaires, which were screened as preparation for the focus groups. The participants were also given ample opportunity to provide free responses on issues that they wanted to address.

Data Analysis Strategy

The non-parametric repeated measures Wilcoxon signed-ranks test was used to evaluate the difference in performance and suitability between the two rain suits, since this study dealt with repeatedly measured ordinal ratings.

This procedure test determines whether the difference scores (between the rain suits for each criterion) are systematically positive (or negative), and whether this difference is statistically significant (i.e., $p<.05$). In other words, this statistical technique will determine whether one rain suit is significantly (statistically speaking), and consistently superior (or inferior) to the other.

Results and Discussions

The results of the non-parametric tests for each of the questionnaires are as follows:

The 36-item Questionnaire

Since the results from the test sessions Q1 (June), Q2 (October) and the final Exit Q (December) yielded highly similar results, only data from the Exit Q session will be reported. In all test sessions, rain suit B is reported to be superior in most respects compared to rain suit A and to the in-service rain suit.

In essence, the 36 items on this questionnaire (Appendix D) probed into core areas of evaluation:

- Protection from Elements
- Moisture Management
- Thermal Regulation
- Adjustment & Fit
- Appearance
- Durability
- Ease of Maintenance & Stowage
- Compatibility
- Functionality (does the job)
- Usability (ease of use)
- Comfort
- Serviceability (ready to put into service)

Items 18 and 19 have a response frequency count of 2, which indicates that most of the twenty participants did not have the opportunity to use the rain suits with the fragmentation vest. These two items were eliminated from the statistical analysis.

Of the remaining 34 items, rain suit B is perceived to be consistently and significantly superior to rain suit A ($p<.05$) on 28 items. For the remaining 6 items, the Wilcoxon test indicates that there are no significant differences ($p>.05$) between rain suit A and B.

Participants perceived rain suit B to be significantly superior to rain suit A, for the following 28 items:

- Item 1: Ability to keep comfortably warm in cold weather.
- Item 2: Ability to keep comfortably cool in hot weather.
- Item 6: Ability to block wind.
- Item 7: Water-tightness of seams.
- Item 8: Endurance to rough usage.
- Item 9: Ease of maintenance.
- Item 10: Ability to move around without generating a lot of noise.
- Item 11: Effectiveness of CADPAT.
- Item 14: Compatibility with combats.
- Item 15: Ability to move (not feeling restricted) when soaked.
- Item 16: Not feeling restricted while operating vehicle or machinery.
- Item 17: Ability to dry quickly.
- Item 20: Keeping rain out while wearing webbing.
- Item 21: Allows for temperature regulation, while wearing webbing.
- Item 22: Keeping rain out while carrying rucksack.
- Item 23: Allows for temperature regulation, while carrying rucksack.
- Item 24: Anti-static build-up.
- Item 25: Agreeable military look/appearance.
- Item 26: Allows for sufficient airflow to maintain comfort.
- Item 27: Ability to not feel clammy.
- Item 29: Overall ability to remain cool.
- Item 30: Overall ability to keep rain out.

Item 31: Allows for drying of wet underlying combat clothing.

- Item 32: Overall Comfort.
- Item 33: Overall usability (ease of use).
- Item 34: Overall functionality (does the job).
- Item 35: Overall compatibility with other clothing and equipment.
- Item 36: Overall serviceability (ready to put into service).

Whereas, participants did not perceive a significant difference between rain suit A and rain suit B, on the following 6 items:

- Item 3: Ease of Packing Rain Suit.
- Item 4: Ease of Adjusting and Fit.
- Item 5: Weight.
- Item 12: Tendency to reflect light (give out a shine).
- Item 13: Interfere with weapon operation.
- Item 28: Tendency to retain odour.

Moreover, when comparing the mean ratings, rain suit B is reported to be superior to the in-service rain suit in all but one item - Item 3 (Ease of packing).

Rain suit A, however, is perceived as inferior to the in-service rain suit on:

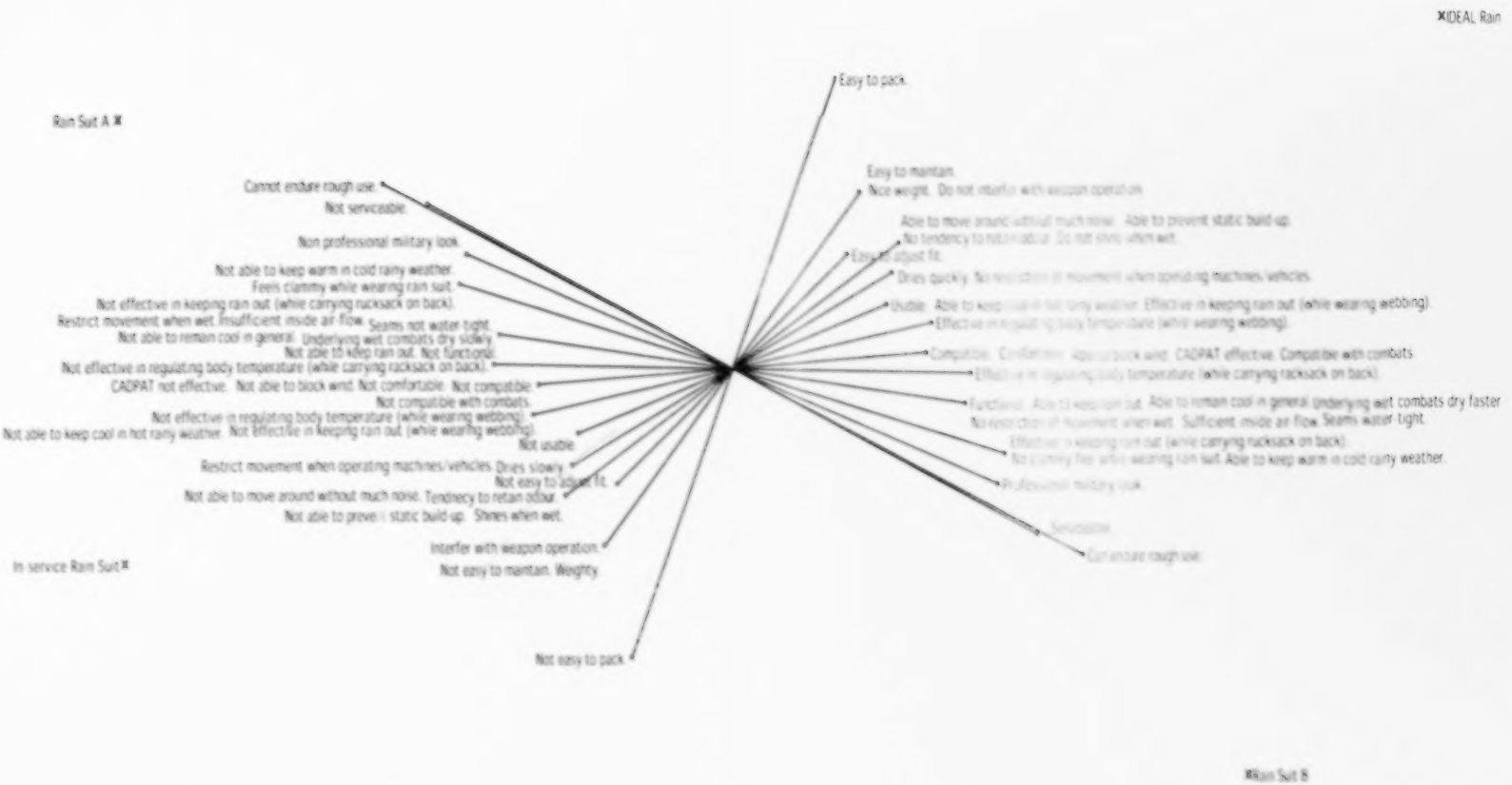
- Item 1: Ability to keep comfortably warm in cold weather.
- Item 2: Ability to keep comfortably cool in hot weather.
- Item 3: Ease of packing.
- Item 7: Water-tightness of seams.
- Item 8: Ability to endure rough use.
- Item 10: Ability to move without generating excessive noise.
- Item 20: Effective in keep rain out while wearing webbing.
- Item 21: Allows for body temperature regulation, with webbing.
- Item 22: Effective in keeping rain out, with rucksack.
- Item 23: Allows for body temperature regulation, with rucksack.

- Item 25: Agreeable military look/appearance.
- Item 27: Ability to not feel sticky and damp (clammy).
- Item 29: Overall ability to remain cool.
- Item 30: Overall ability to keep rain out.
- Item 34: Overall functionality.
- Item 36: Overall Serviceability (ready to put into service).

An integrated comparison: Bi-plots

The Singular Value Decomposition Bi-plot shown in Figure 2 depicts a summary of the inter/intra-association among the rain suits and the evaluation criteria. The bi-plot represents a multi-dimensional view/interpretation of the complex associations between/among rain suits and evaluation criteria.

Figure 2. Bi-plot: An integrated comparison of rain suits


IDEAL Rain
Rain Suit A
In service Rain Suit
Rain Suit B
Easy to pack.
Easy to maintain.
Nice weight. Do not interfer with weapon operation.
Able to move around without much noise. Able to prevent static build up.
No tendency to retain odour. Do not shine when wet.
Easy to adjust fit.
Dries quickly. No restriction of movement when operating machines/vehicles.
Usable. Able to keep cool in hot rainy weather. Effective in keeping rain out (while wearing webbing).
Effective in regulating body temperature (while wearing webbing).
Compatible. Comfortable. Able to block wind. CADPAT effective. Compatible with combats.
Effective in regulating body temperature (while carrying racksack on back).
Functional. Able to keep rain out. Able to remain cool in general. Underlying wet combats dry faster.
No restriction of movement when wet. Sufficient inside air flow. Seams water tight.
Effective in keeping rain out (while carrying racksack on back).
Not clammy feel while wearing rain suit. Able to keep warm in cold rainy weather.
Professional military look.
Serviceable.
Can endure rough use.
Cannot endure rough use.
Not serviceable.
Non professional military look.
Not able to keep warm in cold rainy weather.
Feels clammy while wearing rain suit.
Not effective in keeping rain out (while carrying racksack on back).
Restrict movement when wet. Insufficient inside air flow. Seams not water tight.
Not able to remain cool in general. Underlying wet combats dry slowly.
Not able to keep rain out. Not functional.
Not effective in regulating body temperature (while carrying racksack on back).
CADPAT not effective. Not able to block wind. Not comfortable. Not compatible.
Not compatible with combats.
Not effective in regulating body temperature (while wearing webbing).
Not able to keep cool in hot rainy weather. Not effective in keeping rain out (while wearing webbing).
Not usable.
Restrict movement when operating machines/vehicles. Dries slowly.
Not easy to adjust fit.
Not able to move around without much noise. Tendency to retain odour.
Not able to prevent static build up. Shines when wet.
Interfer with weapon operation.
Not easy to maintain. Weighty.
Not easy to pack.

In the bi-plot there is a point for each of four rain suits (i.e., rain suits A and B, the in-service rain suit and an "ideal" rain suit), as well as a bi-polar (two poles) ray for each evaluation criterion. If two rain suits (or evaluation criteria) are closely associated, their points/poles will be close together and fall in the same direction from the origin. Moreover, if the rain suits and evaluation criteria are associated with each other, their points will fall in approximately the same direction away from the origin, and are located in the same proximity on the bi-plot.

By examining the bi-plot, we can see that rain suit B is closer in proximity to the ideal rain suit, since both are on the right quadrants. Rain suit A and the in-service rain suit are located on the left quadrants, hence rain suit A is more closely associated to the in-service rain suit.

Further examination of the rain suit (points) and evaluation criteria (poles) yields some interesting clues regarding why rain suit A is inferior to rain suit B. Also identified are the criteria that need to be improved, in order to refine rain suit B, so that it will be perceived as more ideal. Participants felt that rain suit A is not ready to put into service because it cannot endure rough usage, lacks a professional military appearance, is unable to keep the wearer warm in cold weather, feels clammy, and fails to keep rain out.

Although rain suit B is far superior to rain suit A, the following refinements are suggested to make it closer to the ideal rain suit: making it more compact, lighter, less noisy, less shiny, better able to prevent static build-up, easier to fit and adjust, dry quicker, and better able to regulate body temperature.

It should be pointed out, however, that the X and Y axes shown in Figure 2 are not to scale. The majority of the weight of the decisions making up the evidence of whether [illegible] more or less ideal, lies along the X-axis. This supports the opinions given through the questionnaires and focus groups that the B suit is significantly better than the in-service rain suit, or the A suit. The participants made it quite clear they are willing to accept rain suit B "as is", right now. The Y-axis has been expanded to give some insight as to what (if anything) can be done to improve the B suit even more, if that question is raised.

The 15-item design features checklist

The purpose of administering this checklist is to investigate whether design and feature related issues are acceptable to the participants, and how they compare to those in the in-service rain suit.

In essence, the 15-item design questionnaire/checklist probed into core design features such as:

- Hood
- Elastic Draw Cord at Bottom Sides of Jacket
- Large Jacket Pockets
- Tapered Cut at Back of Jacket
- Velcro on Cuffs
- Openings Across the Back
- Zippered Vent Openings Under the Arm
- Zippered Pass Through on Chest
- Elastic Draw Cord at Waist
- Stretch Cuffs
- Elastic Pull Through between Legs
- Zippered Pant Pockets
- Velcro/Zipper Leg Closure System
- Elasticized Drawstring Waistband
- Is the Inclusion of a Pant Fly desirable?

Agreement of a given feature is assumed, if greater than 85% of all participants share the same opinion. All but two design features met this level of agreement. The two exceptions were:

- *"The hood should be removable".*

For rain suit A: 35% Yes, 65% No
For rain suit B: 60% Yes, 40% No

- *"The vent opening on the back provides acceptable airflow to keep me cool."*
For rain suit A only: 75% Yes, 25% No

Hence, the hood and back vent warrant further attention, and might require further refinement.

On this questionnaire, participants also made comparison ratings relative to the in-service rain suit. All features of rain suit B are perceived as positive improvements over those of the in-service rain suit. This indicates that the participants welcomed the new design features being introduced, thereby validating the features.

Interaction with fabric/material

Since rain suits A and B are of the same design, one would expect to see no differences between these ratings on each design feature. However, two features did show a significant difference ($p<.05$), which indicates that the performance of these two features might have been affected by the rain suit fabric. In other words, these are material related issues that would require improvement.

The two design features identified are (1) Jacket Bottom Sides Draw String Cords, and (2) Pants Elasticized Drawstring Waistband. Rain suit B is perceived to be significantly superior than rain suit A for both features. A possible explanation of this might be that the smooth fabric surface of rain suit A caused the drawstrings to loosen, and hence these make it more difficult to maintain a proper fit.

The Order of Importance of Design Features Questionnaire

The Order of Importance of Design Features Questionnaire was developed in hopes of providing guidance on where to place design emphasis (compromise) if two desired features are in conflict. By examining the mean ratings and sorting them by rank, all design features were deemed to be essential to the design of an effective rain suit, some more essential than others. The following order of importance of design features was determined.

Starting with the most essential group of features on the rain jacket, they are:

- Hood, Jacket Zipper
- Hood Drawstring, Storm Cuffs
- Drawstring Hem, Back Vent Opening, Storm Flap Zip Pockets, Tapered Back, Velcro Cuffs, Front Velcro Closures
- Drawstring Waistband, Underarm Zip Vents
- Velcro Hood Adjustment
- Zipper Pass-through
- Loop & Tab Drawstring that secures the jacket between the legs

For rain pants, they are:

- Elastic Waistband, Pant Cuff Zipper, Elastic Pant Cuffs, Zippered Pockets
- Elastic Drawstring
- Velcro Cuff Closure
- Care: Shrinkage
- Stowage: In Webbing, Vehicle, Bulk, and Weight

EXIT Questionnaire

This questionnaire was administered at the conclusion of the rain suit trial, before conducting the focus group. It essentially probed into specific areas of performance of the rain jacket and pants, including:

- Overall ratings
- Specific design features and fit issues
- Assessment of the whole item, regarding activities, durability, care, suitability for various weather conditions, stowage, adjustment, vehicles, and compatibility.

The empirical findings regarding these specific areas are as follows.

Overall Ratings

Rain suit B (both jacket and pants) is significantly ($p<.05$) and consistently superior to rain suit A, across the entire set of overall ratings in:

- Appearance
- Fit
- Rain Protection
- Wind Protection
- Functionality
- Usability
- Physical Comfort
- Maintainability
- Durability
- Overall Comfort & Thermal Comfort
- Serviceability

Specific Design Features and Fit issues

Rain Jacket

Rain jacket B is found to be significantly and consistently superior to rain jacket A, except for the following items, where participants did not find a difference between rain jackets A and B (see Appendix A for complete list):

- Hood and Velcro Hood Adjustment
- Jacket Zipper
- Drawstring Hem
- Zipper Pass-Through
- Activities: Reaching, Crawling, Climbing
- Compatibility: Fragmentation Vest, LWTU
- Weight on Body, Ease of Storage, Bulk in Webbing.

All items of rain jacket B were deemed to be at least borderline acceptable, whereas, on rain suit A, the following design features and related issues were deemed to be unacceptable (see Appendix A for complete list):

- Durability of the Hood.
- Suitable for Cold Weather (-10°C to 10°C), Warm Weather (21°C to 25°C), Hot Weather (26°C & above), Snow, Rain, and Ice.
- Durability: Tears, Wear, Snagging, Stitching, and Material.
- Care issue: Repairs.
- Noise and Breathability of Material.

Rain Pants

Rain pants B is found to be significantly and consistently superior to rain pants A, except for the following items (see Appendix A for complete list), where no significant differences were found between rain pants A and B.

- Zippered Pocket
- Elasticized Pant Cuff
- Cuff Velcro Closure
- Care: Shrinkage
- Stowage: In Webbing, In Vehicle, Weight
- Weight on Body, Ease of Storage

Moreover, all items of rain jacket B were deemed at least borderline acceptable, whereas the following design features and related issues of rain suit A were deemed to be unacceptable (see Appendix A for complete list):

- Durability: Tears, Wear, Snagging, & Material
- Care: Repairs
- Use in: Cold Weather (-10°C to 10°C), Warm Weather (21°C to 25°C), Hot Weather (26°C & Above), Snow, Rain, and Ice
- Breathability of Material
- Noise
- Ventilation

All in all, the majority of participants see rain suit B as the superior rain suit. However, opinions were offered on how to improve/modify some design features further.

Conclusion: A summary of findings substantiated by focus group feedback

This section summarizes the findings presented in the result section, and integrates them with the supportive feedback from the exit focus group. The focus group was conducted at the conclusion of the field trials in December.

The summary of each rain suit is presented below, followed by recommendations to improve rain suit B.

Rain suit A

Material related issues:

- Shiny, worst when wet, compromise concealment.
- Non-professional and cheap feel.
- Too thin, not durable, rips on pants, hood, sleeves, hip area.
- Too thin, lots of cold transfer, hence feels too cold in cold weather, and too hot in warm weather.
- Poor ventilation, sweat a lot, material sticks to body, preventing proper air-flow through the vents.
- Condensation from inside, feels clammy.
- Not compatible with Combats, "Garrison thing".
- Wrinkle badly.
- Don't dry quick enough.
- Useless to repair.

Other issues:

- Rain suit A is relative more compact, & weighs lighter than rain suit B.
- CAPAT design is good.
- Worse than the in-service rain suit.

- Zipper leaks around the armpit.

Rain suit B:

Material related issues:

- Still shines a bit.
- Fabric tends to bubble.

Other issues:

- Bulky, pants alone will stuff up backpack, the jacket will not be able to fit into the backpack.
- Zipper leaks around the armpit.

Recommended Modifications

The participants also provided a list of modifications that they would like to see implemented; these are:

- Replace Velcro with snaps, on the whole rain suit.
- Replace all zippers with heavy-duty design.
- Extend the collar with attachment to hold it down the hood to the neck region, to provide better shelter from the elements.
- Adopt a peak design for the hood.
- Ability to seal vent across the back and extending the flap.
- A double fold design for the armpit, the cutting currently fans out too much.
- Remove or enlarge the chest pass through.
- Add fly zipper and side cargo pockets to pants.
- Reinforcement around the knee and elbow regions.
- The cord between the legs is not essential, but can remain if needed.
- Size the jacket and pants separately to optimize fit.

Conclusion

Rain suit B is significantly superior to rain suit A and the in-service rain suit. Moreover, rain suit A is perceived as being inferior to the in-service rain suit. Most of the problems identified in rain suit A are material/fabric related issues, whereas in rain suit B, which is made of a breathable laminate, the fabric is perceived as close to ideal. The overall design of rain suit B could still use some minor improvements, but is acceptable enough to be put into service as it stands.

Appendices

Appendix A: Improved Rain Suit Features.

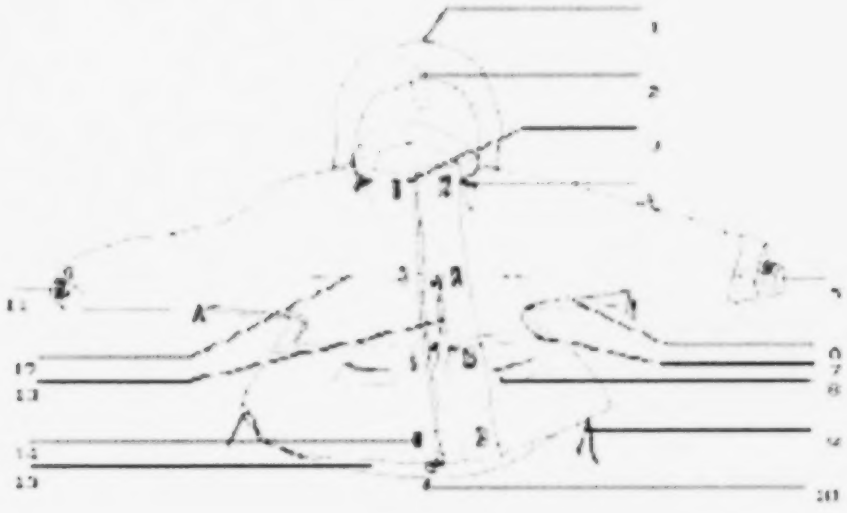
Appendix B: An Introduction to the Repertory Grid Technique.

Appendix C: Photographs of CF soldiers wearing the on-trial rain suits, while training in the field.

Appendix D: Questionnaires.

Appendix A: Improved Rain Suit Features

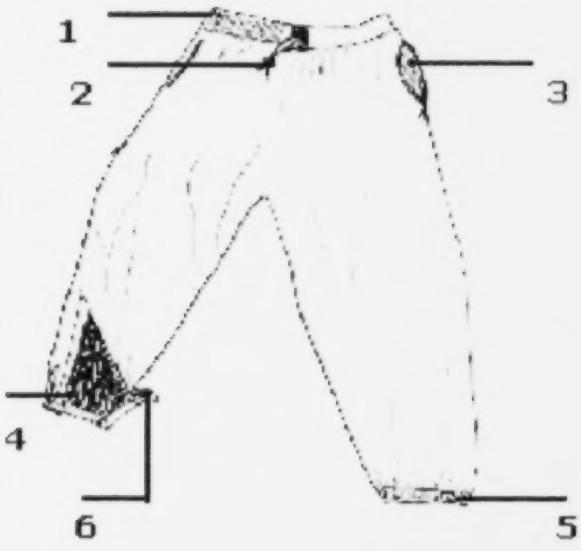
Rain Jacket



Improvements to jacket

Feature	Highlight
1. Hood	Zips into collar.
2. Hood Velcro adjustment	Allows for better fit.
3. Jacket Zipper	Three-way fold, protected by storm flap and zips to chin.
4. Hood Drawstring	Allows for better adjustment.
5. Storm Cuff	Inner storm cuffs made of a Lycra-Spandex material.
6. Underarm Vents	Zipped vents, lined with mosquito netting.
7 Waistband	Elasticized drawstring allows for better adjustment..
8. Pocket	Zippered with storm flaps, jacket tucks away into one of the pockets for storage.
9. Hem Drawstring	Elasticized drawstring,
10. Hem pull-through	A loop and tab feature secures the jacket between the legs to prevent billowing during high winds and driving rain.
11. Velcro Cuff	Modified Velcro closure.
12. Back Vent Opening	Lined with mosquito netting.
13. Zipper Pass-Through	Enables access to shirt pockets.
14. Front Velcro Closures	To secure the storm flap.
15. Tapered Back	The "Beaver tail".

Rain Pants



Improvements to pants

Feature	Highlight
1. Elasticized Waistband	Allows for better adjustment.
2. Elasticized Drawstring	Allows for better adjustment.
3. Side Pocket	Zippered.
4. Pants Cuff Zipper	To facilitate donning and doffing over top of footwear, and keep the rain out.
5. Elasticized Pant Cuff	To facilitate donning and doffing over top of footwear, and keep the rain out..
6. Cuff Velcro Closure	To facilitate donning and doffing over top of footwear, and keep the rain out..

Appendix B: An Introduction to the Repertory Grid Technique

Typically, the Repertory Grid elicitation procedure involves the following steps:

Step 1:

With prompting from a computerized Repertory Grid program (Centre for Person-Computer Studies, 1990), a person (SME) compares selected elements or objects (e.g. rain suit A, rain suit B, in-service rain suit and an imaginary ideal rain suit), and assigns positive and negative constructs (i.e. evaluation criteria) to the elements based on their personal experience with them. The person continues to rate and rank order the elements on the self-generated bipolar constructs or evaluation criteria until the person runs out of ideas. This results in a two-way classification of interlaced personal evaluation data – the Repertory Grid matrix.

Step 2:

From examination of the grid matrix, a researcher can determine:

a) which constructs (evaluation criteria) are assigned to each element (rain suit);

b) which elements (rain suits) are perceived to be most similar (possessing a similar profile of criteria or constructs);

c) which elements have a profile most similar to the "ideal" or desired element (the ideal rain suit); and,

d) what judgements do soldiers in the field make about these different rain suit.

Thus, a SME with extensive field experience is asked to describe how he/she distinguishes between elements of the subject matter within a specific context using a compare-and-contrast process. When analyzed, this process leads to the development of a matrix, i.e. the Repertory Grid, which shows how the SME describes the subject matter in his/her own terms. The grid data is subjected to statistical analyses to yield a graphical representation of the structure of the SME's perceptions of the subject matter, which is used by the investigator in translating implicit data to explicit data. In this manner, the Repertory Grid program enables researchers to make precise statements as well as confident predictions about the mental models of people concerning a particular subject matter. This unique investigative technique also tends to by-pass the influence of the observer's initial frame of reference on what was observed, hence minimizing the effect of observer bias and over-reliance on the researchers.

Applied to the context of rain suits, the Repertory Grid technique allows a SME to generate and explore his/her own evaluation criteria (constructs) about rain suit acceptability. Moreover, the Repertory Grid technique enables researchers to explore and reveal constructs (evaluation criteria) on the subject matter, and consolidates key items for questionnaire design purposes.

In this study, the SME had extensive infantry field experience using 3 rain suits, namely, rain suit A, rain suit B and the in-service rain suit. These 3 rain suits plus an 'ideal' rain suit (as perceived by the SME) are introduced as the Repertory Grid "elements" to the SME. The choice of elements (the 4 rain suits) and an infantry field scenario focuses the grid onto the set of possible constructs (evaluation criteria) to be investigated e.g. "to explore identifiable factors of acceptable rain suits". The SME was given ample opportunity to construe (generate distinctions concerning) all elements (rain suit) used in the study. As a result, 36 constructs (evaluation criteria) were elicited from the SME, and were used as the basis of item formulation for the questionnaires used in this study.

Appendix C: Photographs of CF soldiers wearing the on-trial rain suits, while training in the field.

Appendix D: Questionnaires

D-1 : 36-Item Comparison Questionnaire.

D-2: 15-Item Design Features Checklist.

D-3: Order of Importance of Design Features.

D-4: Exit Questionnaire.

D-1: 36-Item Comparison Questionnaire.

Rain suit questionnaire Last 3 digits-SN [ ][ ][ ]

Compared to the current in-service rain suit, comment on rainsuit A and B in the following evaluation criteria:

1	2	3	4	5	6	7	8	9
Very inferior				No difference				Very superior
1. Ability to keep me comfortably warm in cold rainy weather.								
A ○	○	○	○	○	○	○	○	○
B ○	○	○	○	○	○	○	○	○
2. Ability to keep me comfortably cool in hot rainy weather.								
A ○	○	○	○	○	○	○	○	○
B ○	○	○	○	○	○	○	○	○
3. Ease of packing my rain suit.								
A ○	○	○	○	○	○	○	○	○
B ○	○	○	○	○	○	○	○	○
4. Ease of adjusting my rainsuit to fit my body.								
A ○	○	○	○	○	○	○	○	○
B ○	○	○	○	○	○	○	○	○
5. Weight of the rain suit.								
A ○	○	○	○	○	○	○	○	○
B ○	○	○	○	○	○	○	○	○
6. Ability to block wind.								
A ○	○	○	○	○	○	○	○	○
B ○	○	○	○	○	○	○	○	○
7. Watertightness of seams.								
A ○	○	○	○	○	○	○	○	○
B ○	○	○	○	○	○	○	○	○
8. Endurance to rough usage.								
A ○	○	○	○	○	○	○	○	○
B ○	○	○	○	○	○	○	○	○
9. Ease of maintenance.								
A ○	○	○	○	○	○	○	○	○
B ○	○	○	○	○	○	○	○	○
10. Ability to move around without generating a lot of noise.								
A ○	○	○	○	○	○	○	○	○
B ○	○	○	○	○	○	○	○	○
11. Effectiveness of temperate CADPAT.								
A ○	○	○	○	○	○	○	○	○
B ○	○	○	○	○	○	○	○	○
12. Tendency for my rain suit to reflect light (shine) when wet.								
A ○	○	○	○	○	○	○	○	○
B ○	○	○	○	○	○	○	○	○

Rain suit questionnaire Last 3 digits-SN | | | | 2

Compared to the current in-service rain suit, comment on rainsuit A and B in the following evaluation criteria:

1	2	3	4	5	6	7	8	9
Very inferior				No difference				Very superior
13. Ability to operate weapons without interference from rain suit.								
A ○	○	○	○	○	○	○	○	○
B ○	○	○	○	○	○	○	○	○
14. Compatibility with combats.								
A ○	○	○	○	○	○	○	○	○
B ○	○	○	○	○	○	○	○	○
15. Ability to move (not feeling restricted) when rain suit is soaked.								
A ○	○	○	○	○	○	○	○	○
B ○	○	○	○	○	○	○	○	○
16. Ability to move (not feeling restricted) while operating vehicles or other machinery.								
A ○	○	○	○	○	○	○	○	○
B ○	○	○	○	○	○	○	○	○
17. Dries quickly.								
A ○	○	○	○	○	○	○	○	○
B ○	○	○	○	○	○	○	○	○
18. Effectiveness in keeping the rain out, while I wear my frag vest.								
A ○	○	○	○	○	○	○	○	○
B ○	○	○	○	○	○	○	○	○
19. Effectiveness in regulating my body temperature, while I wear my frag vest.								
A ○	○	○	○	○	○	○	○	○
B ○	○	○	○	○	○	○	○	○
20. Effectiveness in keeping the rain out, while I wear my webbing.								
A ○	○	○	○	○	○	○	○	○
B ○	○	○	○	○	○	○	○	○
21. Effectiveness in regulating my body temperature, while I wear my webbing.								
A ○	○	○	○	○	○	○	○	○
B ○	○	○	○	○	○	○	○	○
22. Effectiveness in keeping the rain out, while I am carrying my rucksack on my back.								
A ○	○	○	○	○	○	○	○	○
B ○	○	○	○	○	○	○	○	○
23. Effectiveness in regulating my body temperature, while I am carrying my rucksack on my back.								
A ○	○	○	○	○	○	○	○	○
B ○	○	○	○	○	○	○	○	○
24. Effectiveness in countering static build-up.								
A ○	○	○	○	○	○	○	○	○
B ○	○	○	○	○	○	○	○	○

Rain suit questionnaire Last 3 digits-SN ☐☐☐

Compared to the current in-service rain suit, comment on rainsuit A and B in the following evaluation criteria:

1 Very inferior	2	3	4	5 No difference	6	7	8	9 Very superior
25. Agreeable military look/appearance.								
A ○	○	○	○	○	○	○	○	○
B ○	○	○	○	○	○	○	○	○
26. Ability for sufficient air to flow inside the rain suit keeping me comfortable.								
A ○	○	○	○	○	○	○	○	○
B ○	○	○	○	○	○	○	○	○
27. Ability not to feel sticky and damp (clammy) while wearing my rain suit.								
A ○	○	○	○	○	○	○	○	○
B ○	○	○	○	○	○	○	○	○
28. Tendency to retain odour from sweat and dirt (the lesser the tendency the more superior it is).								
A ○	○	○	○	○	○	○	○	○
B ○	○	○	○	○	○	○	○	○
29. Overall ability to remain cool when wearing my rain suit.								
A ○	○	○	○	○	○	○	○	○
B ○	○	○	○	○	○	○	○	○
30. Overall ability to keep the rain out.								
A ○	○	○	○	○	○	○	○	○
B ○	○	○	○	○	○	○	○	○
31. Allows drying of underlying combat clothing (if it got wet for any reason, while still wearing the rain suit).								
A ○	○	○	○	○	○	○	○	○
B ○	○	○	○	○	○	○	○	○
32. Overall comfort.								
A ○	○	○	○	○	○	○	○	○
B ○	○	○	○	○	○	○	○	○
33. Overall usability (ease of use).								
A ○	○	○	○	○	○	○	○	○
B ○	○	○	○	○	○	○	○	○
34. Overall functionality (do the job).								
A ○	○	○	○	○	○	○	○	○
B ○	○	○	○	○	○	○	○	○
35. Overall compatibility with other clothing and equipment.								
A ○	○	○	○	○	○	○	○	○
B ○	○	○	○	○	○	○	○	○
36. Overall serviceability (ready to put into service).								
A ○	○	○	○	○	○	○	○	○
B ○	○	○	○	○	○	○	○	○

D-2: 15-Item Design Features Checklist.

Rain Suit Type ☐ Last 3 digits-SN ☐☐☐

Rain Suit Design Features Checklist

Extremely Poor ☹			No difference 😐			Extremely Good ☺
1	2	3	4	5	6	7
1. Hood Design						
a) I believe the fold-away hood design into the zippered collar is an acceptable way to stow the hood away.					Y ○	N ○
b) I believe the fold-away hood design is acceptably comfortable.					Y ○	N ○
Rate the on-trial rain suit with respect to (i.e., in comparison to) the in-service rain suit for this feature:						
○	○	○	○	○	○	○
c) I believe the hood should be removable.					Y ○	N ○
2. Elastic Draw Cord at Bottom Sides of Jackets						
a) I believe the draw cords do an acceptable job at keeping the elements out.					Y ○	N ○
Rate the on-trial rain suit with respect to (i.e., in comparison to) the in-service rain suit for this feature:						
○	○	○	○	○	○	○
3. Large Jacket Pockets						
a) I believe the inclusion of usable pockets on the rain suit is acceptable.					Y ○	N ○
Rate the on-trial rain suit with respect to (i.e., in comparison to) the in-service rain suit for this feature:						
○	○	○	○	○	○	○
b) I believe the flaps over the pockets do an acceptable job at keeping the elements out.					Y ○	N ○
Rate the on-trial rain suit with respect to (i.e., in comparison to) the in-service rain suit for this feature:						
○	○	○	○	○	○	○
4. Tapered Cut at Back of Jacket						
a) I believe the extended material on the bottom of the jacket provides acceptable protection from the elements.					Y ○	N ○
Rate the on-trial rain suit with respect to (i.e., in comparison to) the in-service rain suit for this feature:						
○	○	○	○	○	○	○
5. Velcro on Cuffs						
a) I believe the Velcro on the cuffs keep the elements out of the inside of the sleeve acceptably.					Y ○	N ○
Rate the on-trial rain suit with respect to (i.e., in comparison to) the in-service rain suit for this feature:						
○	○	○	○	○	○	○
6. Openings Across the Back						
a) I believe the opening on the back provides acceptable airflow to keep me cool.					Y ○	N ○
b) I believe the flap over the opening to keep the elements out is acceptable.					Y ○	N ○
7. Zippered Vent Openings Under the Arm						
a) I believe the vent openings under the arms are acceptable for keeping me cool.					Y ○	N ○
8. Zippered Pass Through on Chest						
a) I believe the pass through allowing me to easily access my inside shirt pockets is acceptable.					Y ○	N ○
b) I believe the pass through is acceptably designed to be able to keep out the elements					Y ○	N ○

RCHECK-2

Rain Suit Type ☐ Last 3 digits-SN ☐☐☐

Extremely Poor ☹			No difference 😐			Extremely Good ☺
1	2	3	4	5	6	7
9. Elasticised Draw Cord at Waist						
a) I believe the adjustability of the draw cord is acceptable					Y ○	N ○
10. Stretch Cuff						
a) I believe the stretch cuff is acceptably comfortable.					Y ○	N ○
b) I believe the stretch cuff used to keep the elements out of the inside of the sleeve is acceptable.					Y ○	N ○
11. Elastic Pull Through Between Legs						
a) I believe the pull through does an acceptable job in keeping the elements out.					Y ○	N ○
12. Zippered Pant Pockets						
a) I believe the pant pockets are acceptable.					Y ○	N ○
b) I believe the zippers on the pant pockets are acceptable.					Y ○	N ○
13. Velcro/Zipper Leg Closure System						
a) I believe the Velcro on the cuff keeps the elements out of the inside of the pant acceptably.					Y ○	N ○
b) I believe the zipper leg closure protects against the elements acceptably.					Y ○	N ○
c) I believe the leg closure system allows for clothing adjustments acceptably.					Y ○	N ○
d) I believe the leg closure system assists acceptably with putting on or removing the rain pants.					Y ○	N ○
e) I believe the leg closure system is useful in tying back excess material which could impede mobility.					Y ○	N ○
14. Elasticized Drawstring Waistband						
a) I believe the elasticized drawstring waistband allows for proper adjustment of the rain pants.					Y ○	N ○
Rate the on-trial rain suit with respect to (i.e., in comparison to) the in-service rain suit for this feature:						
○	○	○	○	○	○	○
15. I believe the inclusion of a pant fly will be desirable/beneficial.					Y ○	N ○

D-3: Order of Importance of Design Features.

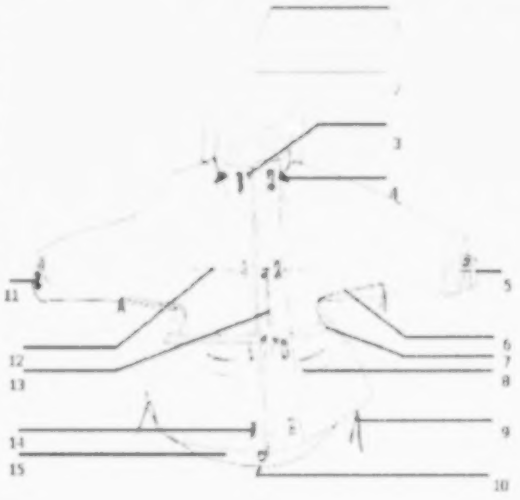
Rate Rain Suit Features

Last 3 digits-SN ☐☐☐

☹ Absolutely Not Essential			😐			☺ Absolutely Essential
○	○	○	○	○	○	○
1	2	3	4	5	6	7

Section A: Rain Jacket

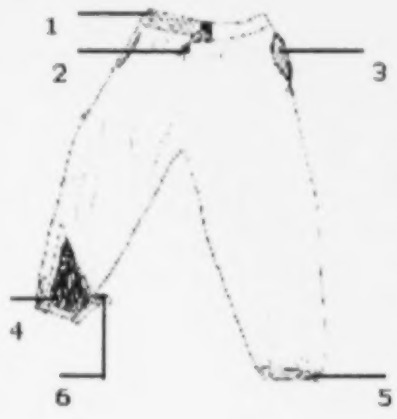
Rate how essential are each of the following features.							
	☹			😐			☺
1. Hood	○	○	○	○	○	○	○
2. Velcro Hood Adjustment	○	○	○	○	○	○	○
3. Jacket Zipper	○	○	○	○	○	○	○
4. Hood Drawstring	○	○	○	○	○	○	○
5. Storm Cuff	○	○	○	○	○	○	○
6. Underarm Zip Vents	○	○	○	○	○	○	○
7. Drawstring Waistband	○	○	○	○	○	○	○
8. Storm Flap Zip Pocket	○	○	○	○	○	○	○
9. Drawstring Hem	○	○	○	○	○	○	○
10. Loop & Tab Drawstring that secures the jacket between the legs	○	○	○	○	○	○	○
11. Velcro Cuff	○	○	○	○	○	○	○
12. Back Vent Opening	○	○	○	○	○	○	○
13. Zipper Pass-Through	○	○	○	○	○	○	○
14. Front Velcro Closures	○	○	○	○	○	○	○
15. Tapered Back	○	○	○	○	○	○	○
	○	○	○	○	○	○	○
	○	○	○	○	○	○	○
	○	○	○	○	○	○	○



Last 3 digits-SN ☐☐☐

Section B: Rain Pants

Rate how essential are each of the following features.	☹			😐			☺
1. Elasticized Waistband	○	○	○	○	○	○	○
2. Elasticized Drawstring	○	○	○	○	○	○	○
3. Zippered Pocket	○	○	○	○	○	○	○
4. Pant Cuff Zipper	○	○	○	○	○	○	○
5. Elasticized Pant Cuff	○	○	○	○	○	○	○
6. Cuff Velcro Closure	○	○	○	○	○	○	○
	○	○	○	○	○	○	○
	○	○	○	○	○	○	○
	○	○	○	○	○	○	○
	○	○	○	○	○	○	○
	○	○	○	○	○	○	○



Section C: Wish list

1. List the features that you would like to ADD to the design of the rain suit.

2. List the features that you would like to REMOVE from the design of the rain suit.

3. List the features that you would like to MODIFY in the design of the rain suit.

D-4: Exit Questionnaire.

Rain Jacket Features & Fit

Last 3 digits-SN ☐☐☐

Rain Jacket Type & Size	A ○ B ○ ☐☐☐
I have worn this garment on (approximately) :	
☐☐	Rainy Days
☐☐	Non-Rainy Days

☹ ☹ ☹ 😐 😐 😐 ☺ ☺ ☺

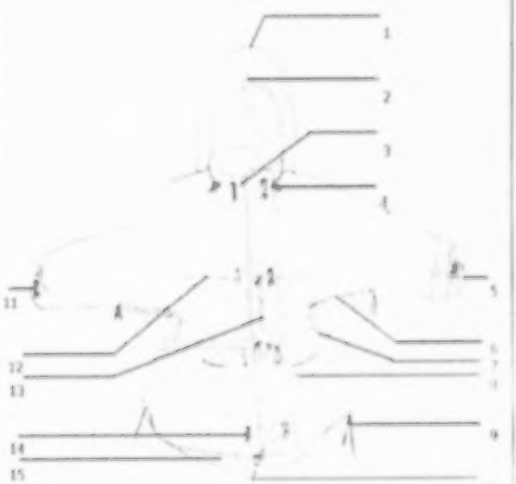
Unacceptable **Acceptable**

○ ○ ○ ○ ○ ○ ○

1 2 3 4 5 6 7

Section A: Specific Features

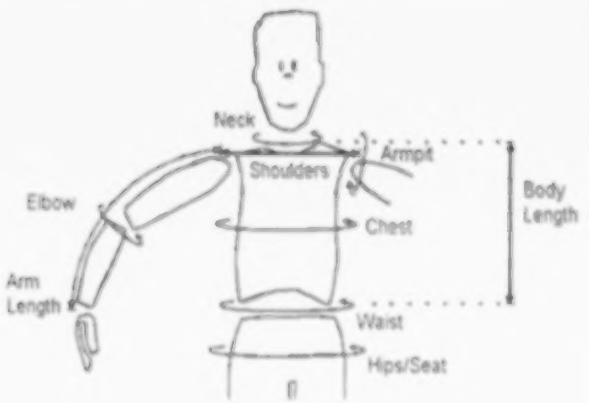
	Function (works well)			Durability (wears well)		
	☹	😐	☺	☹	😐	☺
1. Hood	○	○	○	○	○	○
2. Velcro Hood Adjustment	○	○	○	○	○	○
3. Jacket Zipper	○	○	○	○	○	○
4. Hood Drawstring	○	○	○	○	○	○
5. Storm Cuff	○	○	○	○	○	○
6. Underarm Zip Vents	○	○	○	○	○	○
7. Drawstring Waistband	○	○	○	○	○	○
8. Storm Flap Zip Pocket	○	○	○	○	○	○
9. Drawstring Hem	○	○	○	○	○	○
10. Loop & Tab Drawstring that secures the jacket between the legs	○	○	○	○	○	○
11. Velcro Cuff	○	○	○	○	○	○
12. Back Vent Opening	○	○	○	○	○	○
13. Zipper Pass-Through	○	○	○	○	○	○
14. Front Velcro Closures	○	○	○	○	○	○
15. Tapered Back	○	○	○	○	○	○



Last 3 digits-SN ☐☐☐

Section B: Fit

	Too small	OK	Too big
Neck	○	○	○
Shoulders	○	○	○
Chest	○	○	○
Waist	○	○	○
Seat	○	○	○
Body Length	○	○	○
Armpit	○	○	○
Elbow	○	○	○
Wrist	○	○	○
Arm Length	○	○	○



Section C: Whole Item

Activities	☹	😐	☺	Suitable for	☹	😐	☺	Compatibility	☹	😐	☺
Neck Bending	○	○	○	Cold Weather (-10° C to 10° C)	○	○	○	Shirt, Cbt	○	○	○
Reaching	○	○	○	Cool Weather (11° C to 20° C)	○	○	○	IECS Polar Fleece	○	○	○
Throwing	○	○	○	Warm Weather (21° C to 25° C)	○	○	○	Trousers, Cbt	○	○	○
Trunk Bending	○	○	○	Hot Weather (26° C & above)	○	○	○	Rain Pants	○	○	○
Crouching	○	○	○	Snow	○	○	○	New CF Helmet	○	○	○
Sitting	○	○	○	Rain	○	○	○	NBC IPE	○	○	○
Crawling	○	○	○	Wind	○	○	○	Rucksack	○	○	○
Climbing	○	○	○	Ice	○	○	○	C7 Rifle	○	○	○
Marching	○	○	○	**Stowage**	☹	😐	☺	Std. Webbing	○	○	○
Running	○	○	○	In Vehicles	○	○	○	Gloves, Cbt	○	○	○
Digging	○	○	○	Bulk in Pack	○	○	○	Headsets	○	○	○
Field Living	○	○	○	Weight in Pack	○	○	○	Frag. Vest	○	○	○
Lying Prone	○	○	○	In Webbing	○	○	○		○	○	○

Last 3 digits-SN ☐☐☐

Section C: Whole Item (Continued)

Durability	☹	😐	☺	Adjustment	☹	😐	☺	Other	☹	😐	☺
Tears	○	○	○	Put on	○	○	○	Colour	○	○	○
Wear	○	○	○	Adjust Fit	○	○	○	Noise	○	○	○
Snagging	○	○	○	Take Off	○	○	○	Smell	○	○	○
Stitching	○	○	○		○	○	○	Insect Resistance	○	○	○
Stains	○	○	○		○	○	○	Ease of Mvmnt.	○	○	○
Material	○	○	○		○	○	○	Weight on Body	○	○	○
Care	☹	😐	☺	**Vehicles**	☹	😐	☺	Ease of Storage	○	○	○
Cleaning	○	○	○	Entry	○	○	○	Compatible with CTS WWG	○	○	○
Drying	○	○	○	Exit	○	○	○	Compatible with LWTU	○	○	○
Repairs	○	○	○	Operation	○	○	○	Ventilation	○	○	○
Shrinkage	○	○	○	Maintenance	○	○	○	Breathability of Material	○	○	○
	○	○	○		○	○	○		○	○	○

Section D: Overall Ratings

	☹	😐	☺		☹	😐	☺		☹	😐	☺
Appearance	○	○	○	**Functionality**	○	○	○	**Durability**	○	○	○
Fit	○	○	○	**Usability**	○	○	○	**Overall Comfort**	○	○	○
Rain Protection	○	○	○	**Physical Comfort**	○	○	○	**Thermal Protection**	○	○	○
Wind Protection	○	○	○	**Maintainability**	○	○	○	**Serviceability**	○	○	○

Last 3 digits-SN ☐☐☐

Section E: Comments

Rain Pants Features & Fit

Last 3 digits-SN ☐☐☐

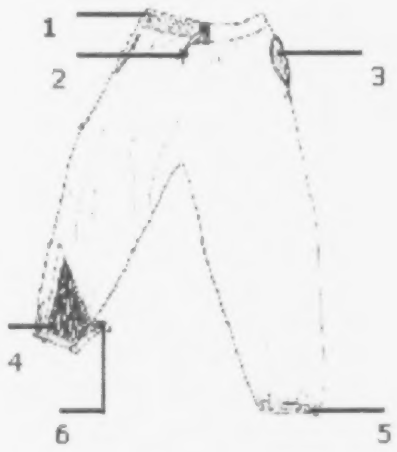
Rain Pants Type & Size	A ○ B ○ ☐☐☐
I have worn this garment on (approximately) :	
☐☐	Rainy Days
☐☐	Non-Rainy Days

☹ ☹ ☹ 😐 😐 ☺ ☺

Unacceptable **Acceptable**

○ ○ ○ ○ ○ ○ ○

1 2 3 4 5 6 7

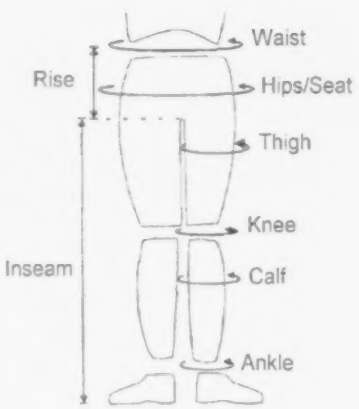


Section A: Specific Features

	Function (works well) ☹ 😐 ☺	Durability (wears well) ☹ 😐 ☺
1. Elasticized Waistband	○ ○ ○ ○ ○ ○ ○	○ ○ ○ ○ ○ ○ ○
2. Elasticized Drawstring	○ ○ ○ ○ ○ ○ ○	○ ○ ○ ○ ○ ○ ○
3. Zippered Pocket	○ ○ ○ ○ ○ ○ ○	○ ○ ○ ○ ○ ○ ○
4. Pant Cuff Zipper	○ ○ ○ ○ ○ ○ ○	○ ○ ○ ○ ○ ○ ○
5. Elasticized Pant Cuff	○ ○ ○ ○ ○ ○ ○	○ ○ ○ ○ ○ ○ ○
6. Cuff Velcro Closure	○ ○ ○ ○ ○ ○ ○	○ ○ ○ ○ ○ ○ ○

Section B: Fit

	Too small	OK	Too big
Waist	○	○	○
Hips/Seat	○	○	○
Rise	○	○	○
Thighs	○	○	○
Knees	○	○	○
Calves	○	○	○
Ankles	○	○	○
Inseam	○	○	○
Length of Pant Cuff Zipper	○	○	○



Rain Pants Features & Fit

Last 3 digits-SN ☐☐☐

Section C: Whole Item

Activities	☹	😐	☺	Suitable for	☹	😐	☺	Compatibility	☹	😐	☺
Trunk Bending	○	○	○	Cold Weather (-10° C to 10°C)	○	○	○	Trousers, Snow	○	○	○
Crouching	○	○	○	Cool Weather (11° C to 20° C)	○	○	○	NBC IPE	○	○	○
Sitting	○	○	○	Warm Weather (21° C to 25° C)	○	○	○	Socks, GS	○	○	○
Crawling	○	○	○	Hot Weather (26° C & above)	○	○	○	Socks, Wool	○	○	○
Climbing	○	○	○	Snow	○	○	○	Boots, Cbt	○	○	○
Marching	○	○	○	Rain	○	○	○	Rain Jacket	○	○	○
Running	○	○	○	Wind	○	○	○	LWTU	○	○	○
Digging	○	○	○	Ice	○	○	○	Shirt, Cbt	○	○	○
Skiing	○	○	○	**Stowage**	☹	😐	☺	Trousers, Cbt	○	○	○
Field Living	○	○	○	In webbing	○	○	○	IECS Polar Fleece	○	○	○
Standing	○	○	○	In Vehicles	○	○	○	Breathability of Material	○	○	○
Lying Prone	○	○	○	Bulk	○	○	○		○	○	○
	○	○	○	Weight	○	○	○		○	○	○
Durability	☹	😐	☺	**Adjustment**	☹	😐	☺	**Other**	☹	😐	☺
Tears	○	○	○	Put on	○	○	○	Colour	○	○	○
Wear	○	○	○	Adjust fit	○	○	○	Noise	○	○	○
Snagging	○	○	○	Take off	○	○	○	Smell	○	○	○
Stitching	○	○	○		○	○	○	Insect Resistance	○	○	○
Stains	○	○	○		○	○	○	Ease of Mvmnt.	○	○	○
Material	○	○	○		○	○	○	Weight on Body	○	○	○
	○	○	○		○	○	○	Ease of Storage	○	○	○
Care	☹	😐	☺	**Vehicles**	☹	😐	☺	Ventilation	○	○	○
Washing	○	○	○	Entry	○	○	○		○	○	○
Drying	○	○	○	Exit	○	○	○		○	○	○
Repairs	○	○	○	Operation	○	○	○		○	○	○
Shrinkage	○	○	○	Maintenance	○	○	○		○	○	○

Last 3 digits-SN ☐☐☐

Section D: Overall Ratings

	☹ 😐 ☺		☹ 😐 ☺		☹ 😐 ☺
Appearance	○○○○○○○	Functionality	○○○○○○○	Durability	○○○○○○○
Fit	○○○○○○○	Usability	○○○○○○○	Overall Comfort	○○○○○○○
Rain Protection	○○○○○○○	Physical Comfort	○○○○○○○	Thermal Protection	○○○○○○○
Wind Protection	○○○○○○○	Maintainability	○○○○○○○	Serviceability	○○○○○○○

Section E: Comments

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1b. PUBLISHING AGENCY DRDC Toronto	

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4. AUTHORS

Ghee W. Ho, Walter R. Dyck

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13. DOCUMENT ANNOUNCEMENT

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14. ABSTRACT

(U) Two versions of the 'improved' CF rain suits were compared by twenty non-commissioned members of the Canadian Forces, who wore the rain suits for a period of eight months. Feedback from evaluation questionnaires and focus groups indicates most of ther problems identified are either material/fabric related, or due to minor design inefficiencies, however, the overall design feature specification is acceptable to put into service as is.

(U) Vingt militaires du rang des Forces canadiennes ont porté pendant une période de huit mois deux versions des combinaisons de pluie « améliorées » des FC en vue de les comparer. La rétroaction obtenue grâce à des questionnaires d'évaluation et à des groupes de consultation montre que les problèmes rencontrés étaient liés soit au matériau/tissu soit à des défauts de conception mineurs. Toutefois, dans l'ensemble, la spécification des caractéristiques de conception est suffisamment acceptable pour être mise en service telle quelle.

15. KEYWORDS, DESCRIPTORS or IDENTIFIERS

(U) rain suits; repertory grid; design features